



Cutting the Gordian Knot:
The History and Process of Building Ships in Bottles

Senior Project

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By

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Abstract

If you go to any tourist gift shop near the coast you're sure to find a plethora of assorted trinkets and souvenirs. The impossible "ship in a bottle" is a classic specimen. But how did that tradition get started? In this project, I set out to research the origins of this obscure craft, learn the secret behind the process, and last but not least, actually build one myself. The paper includes a brief introduction, a historical section, and a section documenting my process. I wrap up with a section on some of the differences between building a model ship with and without the benefit of modern tools, and close with some personal reflections. This project was full of unexpected turns. Many of the areas I thought would be difficult were not actually as hard as they seemed. Some parts I thought would be easy, but in fact presented unforeseen challenges. Overall, the work was completely worthwhile, and it was an incredibly rewarding experience.

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*“One of our sailors throughout the voyage had been working in the dog watches putting a ship into a bottle, a task it had taken twelve months to complete. With endless patience he had built a ship in miniature from pieces of wood whittled with his jackknife, and rigged her correctly with all sails to the royals on her three masts using thin tarred twine for rigging and carefully carved tiny pieces of wood for blocks and tackles. There was nothing omitted . . . What are you going to do with her? I asked. Sell her o’course! How much do you want for her? Two pounds of plug tobacco.” (Bisset, *Sail Ho!*, 147-8)*

INTRODUCTION

There is an old legend about Alexander the Great, who, while visiting Gordium, the capital of Phrygia, encountered a seemingly impossible challenge in the form of a massively complicated knot. Much like the Arthurian sword in the stone, it was said that whoever untied the knot would become the future ruler of Asia. Alexander sliced through the knot with his sword, and went on to fulfill the prophecy. The phrase “Gordian Knot” nowadays refers to a problem which cannot be resolved on its own terms, requiring a bold, innovative solution. The classic ship-in-a-bottle, much like vanishing coins, Rubik’s cubes, and making an egg stand on end, is one of those things that initially seems extremely difficult – if not impossible – to achieve. But in reality, each endeavor only requires knowledge of the secret magic “trick” (and perhaps a small investment of time). A well-executed specimen might spark admiration of the craftsmanship and awe of the tiny detailing, but of course, the million-dollar question is “How did it fit into the bottle?”

Before I settled on this project, I had quite honestly not put much thought into this question. I suppose I assumed the ship was built inside the bottle, with careful use of long tweezers – but again, I hadn't lost sleep over it. The solution is actually quite simple. The ship is almost fully constructed outside the bottle, with collapsible masts and rigging attached to long "setting up threads". Then, it is carefully folded down, easily slid through the bottle's neck, and propped up via pre-rigged threads and tweezers, and the pieces are glued into place. When I learned how relatively simple it was, the project immediately seemed more doable.

The idea to even build a ship-in-a-bottle at all was somewhat random. I am an art major, so I was hoping to do something art-related from the very beginning. I knew that I would need to provide a written component to the project, and thought a medium with some history would be more interesting to read (and write) about. I'm often intrigued by niche art forms that have a tradition attached. One day, the idea to build a ship in a bottle just popped into my head, and the rest is history.

A BRIEF HISTORY

Model ships have been around for long enough that it's practically impossible to pinpoint when the first one was made. However, the practice of putting them inside bottles is a somewhat easier to place. One of the earliest surviving models is a c. 1800 Dutch poon located in the Prins Hendrik Museum in Rotterdam. However, this model is not a true ship-in-a-bottle. For one thing, it is placed in a wide-mouthed vessel, without the challenge of fitting through a narrow neck. It is also positioned vertically, not horizontally. My source for this information included neither a photo, nor a footnote

leading to one. I was also unable to find it through the museum. However, I found an entry on a Portuguese forum for ship-bottling enthusiasts that matched this description (O mar das garrafas). There's a good chance it could be the same one, or at least be a good representation.¹

The real beginning of ship bottling corresponds with the introduction of mass-produced glass bottles in the late nineteenth century. Before then, glass was hand-blown, more delicate, and a lot harder to acquire, especially for a common sailor. It was also liberally taxed by the British government between 1745 and 1845. The earliest true ship-in-bottle specimens are dated sometime around 1860 (Stammers, pg. 94). Mass production of glass bottles would have been in development, leading up to a total manufacturing shift in 1898, thanks to the contributions of Michael J. Owens. Owens was an American bottle maker, born in 1859 in West Virginia. He began working in a glass factory as a child and acquired experience in many different positions before his excellent management skills took him straight to the top of Libbey Glass. His innovation and technical savvy led him to develop multiple patents, resulting in the complete automation of the glass bottling process.

There are some similar art forms that may have led to the development of ships-in-bottles, including the "God in the bottle" and mining bottles. The first consisted of religious scenes/symbols installed in bottles (most specimens from Germany). In in the attached picture², the bottles contain crucifixes and other strange shapes carved from wood and bone. These particular pieces were exhibited by the Tate museum in 2014, and the curators theorized that they were likely created by Irish Catholics.

The second art form, mining bottles, was a practice of mine workers, particularly in the late 17th and 18th centuries, mostly in Germany and Hungary. The miners carved intricate models of mines, and placed them inside glass bottles.³ These creations were known as “Geduldflaschen,” which translates to “patience bottles,” because of the incredible amount of patience required to build one. These were often created as a source of income by injured workers, or able-bodied workers during the winter months.

Surprisingly, there are very few records of sailors constructing these models while actually at sea. This is partly because common sailors rarely kept journals or signed their work. This leaves only the memoirs of higher-ranking officers, who might not note such a trivial detail, especially as many of these biographies were composed later in their lives. However, there are a few records which mention the craft, including the one from British merchant sea captain Sir James Bisset quoted above. It would have been very difficult to create such a finely detailed piece on board a sailing ship. For one thing, it would have to be built on deck during good weather, as the light below would not have been sufficient. Also, since most sailors returned inebriated from their brief times ashore, not many would consider bringing a bottle with them for this purpose. A more likely alternative is that many models were constructed on shore between voyages, or by retired sailors. Many specimens were also made by fishermen and lightshipmen (lightships were vessels that functioned as lighthouses, and their operators would sometimes remain on boat in a fixed location for long periods of time, a perfect site for ship-bottling).

MY PROCESS

Initially, I thought I could find a video tutorial on YouTube for this project. However, there was very little instructional content to be found on the internet at all. This was concerning, and for a short while, I was worried that I might need to change my topic. However, after a brief search in my library's catalogue, I easily found multiple books on the subject. I checked out five of them to compare methods, but my primary guide for the project was *How to Make a Ship in a Bottle*, by Clive Monk, published in 1948 (the oldest one I found). My goal was to construct the model as authentically as possible, while still making use of modern tools. Monk's book is sixty-four pages long and (with the exception of a few pages at the end) entirely devoted to one type of model ship: the *Cutty Sark*.⁴ The *Cutty Sark* was a British tea clipper, built in 1869. She is currently on display in Greenwich, London, beautifully restored and preserved, and a perfect specimen to study for this kind of project. She is the "only complete tea clipper remaining anywhere in the world (Needham, pg 5)." "The *Cutty Sark* sailed 1,050 miles in three days – she was one of the fastest clippers the world has known. Built at Dumbarton in 1869, her name conjures up all the romance and legend of the clippers (Monk, pg. 8)."

The book was clearly written with excellent diagrams, so it was quite easy to follow Monk's instructions. After securing the necessary materials, the first step was to carve out the hull, for which I used a block of pine wood. The hull is actually made of two pieces glued together, then chiseled and sanded as one. Then it is soaked in boiling water to loosen the glue and separated. The purpose of this is to help make it possible to fit through the bottle neck. The lower piece is placed first (secured in the clay "sea"), then

the upper section (with masts and rigging attached and folded) follows and is glued to the lower half once inside. Monk included an extremely helpful diagram for shaping the hull, including a top view outline, and five cross-section templates. “Using a chisel and files, carve the blocks until the templates fit snugly at their appropriate stations (Fig 7), and then smooth up the hull with a piece of medium sandpaper (Monk, pg.13).”⁶

After the hull is finished, I cut some long “shroud slots” along the edges of the main deck and poop deck for the rigging threads to pass through. Next were the bulwarks, guard rails (which were constructed by inserting metal pins into the deck, and then twisting thread between them to form the railings)⁷, and some paper deck coverings (to partially mask the shroud slots). After that was the rigging.⁸ The rigging was arguably the hardest part of the project, and I found myself dreading it. Because I had chosen the *Cutty Sark*, the ship had three masts (fore, main, and mizzen), with sixteen total spars (one for each sail), plus a spanker gaff and boom. Each mast was made in three parts, joined together with glue and bound with thread. If you count the four part bowsprit structure, I filed down thirty-one tiny wooden rods, each no more than 1/16” in diameter, most with a taper. This was probably the most time-consuming part of the project. In order to not lose any of the pieces, I printed out a copy of the diagram, set it in a craft tray, and stuck strips of double sided tape to it so I could place each piece in its appropriate position.⁹ Once all the tiny pieces were joined together in their appropriate places with glue and thread, the masts were wedged into shallow holes in the deck and propped up with strategically placed threads. Rigging loops were made out of thread for more threads to pass through. (These are the threads that are used to set up the ship, once

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inside the bottle). After that, I added some thread braces to the spars, and a thread martingale and dolphin striker to the jibboom.¹⁰

Now, on to the sails. At this point, the ship was already beginning to look pretty credible, but the sails are what really pulled it all together.¹¹ The sails are made of cheap printer paper, cut out of another of Monk's templates, and curled around a wooden dowel to give it a bowed effect. The only sail which is not made of paper is the spanker, which must be cut from fabric, to keep it from crumpling when the ship is folded down.

Once this was finished, it was time to work on the sea. I used air dry clay to form the waves inside the bottle, adding one small roll at a time, and forming the texture to my liking. Monk makes a great observation in the book, that it is important not to form the waves randomly, but to ensure their pattern makes sense with the way the sails are trimmed. For example, if the wind is blowing straight ahead (with the waves following suit, of course), the sails must also be trimmed in that direction. In the case of my model, the sails are tilted in the direction of the viewer, so the waves must run parallel with the ship.

Once the sea is appropriately sculpted and painted, it is time to install the ship. The masts are dislodged from their holes and folded down carefully, to avoid crushing the sails.¹² The ship is then guided in with the help of several long tools, and glued to the bottom piece of the hull. It took a lot longer to do this step than I anticipated. The ship was very difficult to push through the bottle's neck, and it was slow going before it finally went through. Even then, there was some damage done to the sails and some of the detail work, though not terribly noticeable. Once inside, I realized I had made the bowsprit too long, causing it to bump up against the side of the bottle. I had to partially

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remove the ship to trim off a bit. I was also forced to remove the dolphin striker and martingale, in order for the top half of the hull to sit flat against pre-installed bottom half.

Once the ship was securely glued (which took a few tries) I pulled up the masts and rigging via the guiding threads, and nudged the masts into position. I then added a few carved deck furnishings, including a fore-deck hatch, two deckhouses (with two lifeboats on top of one), and a poop deck skylight.). When everything was set, I glued the guiding threads to the tip of the jibboom. To cut the excess thread, I rigged a craft knife blade to a long piece of wire, and carefully sawed through them. After cleaning the paint and glue smears out of the bottle's neck, I corked it and the piece was done.¹⁴

ANACHRONISMS

As I said before, this book was very clearly written and quite easy for me to understand. However, there were a few parts which showed the book's age, that I found humorous. For example, the first diagram in the book (the hull with cross-sections) is given at a $\frac{6}{7}$ scale. This strikes me as a needless complication. There seems to be plenty of room on the page to make it full scale. Why force the reader to do the math? I, enjoying the benefits of life in the 21st century, chose to resize the diagram with my photocopier until it was large enough. However, copiers were only invented in 1938, ten years before the book was published, and I doubt people at that time were able to resize things that easily. It reveals something about that time period, that people like Monk assumed the average reader was skilled enough at math that it would not make a significant difference if the diagram was at $\frac{6}{7}$ scale or full size.

Another example of the book's age, while not as humorous, was his instruction on how to burn the shroud slots. "To burn the holes, use a darning needle bound with wire to a pen-holder or small stick. Heat the point of a needle to red heat over a gas jet, and push the needle through the wood as explained. This will discolor the wood around the slot, but, as a card covering is fitted over the deck and partially covers the shroud slots, this is of no importance." (Monk, pg. 15) Again, I was able to take advantage of modern tools, i.e. my hot knife, to burn the wood, rather than Monk's method.

Finally, my favorite finding was on the subject of creating a molding rod for shaping the clay sea and installing the ship. "The molding rod is a 14-inch x 1/4-inch x 1/8-inch rod of mild steel, bent into a hook at one end (Fig 45). Any local blacksmith will bend this rod up for you in his hearth for a few pence." It makes me laugh to read how matter-of-fact he says this, when, as a reader in 2021, that guidance is completely irrelevant.

CONCLUSION

This project has been an incredibly rewarding experience for me. Toward the beginning, I was torn between making a simpler model (with a single sail) and following this book to make the significantly more complicated *Cutty Sark*. I am very glad I chose the one I did. It was the perfect level of challenging – hard enough to stretch my skills and result in a piece I can be truly proud of, but not so hard that I was completely burnt out by the effort, or tempted to give up midway. It was truly not as hard as it looked, once I read the instructions and took my time through each step. I could easily see myself making more models in the future.

I decided to dub my ship the *U.S.S. Obsolete*. It's a somewhat sad, somewhat satirical reference to the fact that this art form is long out of vogue, and rapidly vanishing. Very few people today would have any desire to embark on such a painstaking and time-consuming project. And yet, I strongly believe that "lost" skills like this, while not particularly "relevant," are far from obsolete and are a worthwhile endeavor, in the way they connect us with our past, and in the way that they give a clear reward to honest, careful work. In the words of Clive Monk: "Now, if you have followed the directions in this book and have worked patiently and to the best of your ability, you will be the proud possessor of an unusual ornament which will always bring a word of admiration from the beholder. With your own two hands you have created something which will be for you 'a thing of beauty and a joy for ever.'" I certainly agree, and this project is easily one of my proudest achievements.

Image Endnotes



¹*Early ship-in-a-bottle, Maritime Museum in Rotterdam c. 1795*



²*“God in a bottle” specimens, Tate Exhibition, 2014*



³Example of a mining bottle



⁴The Cutty Sark on display in Greenwich, London

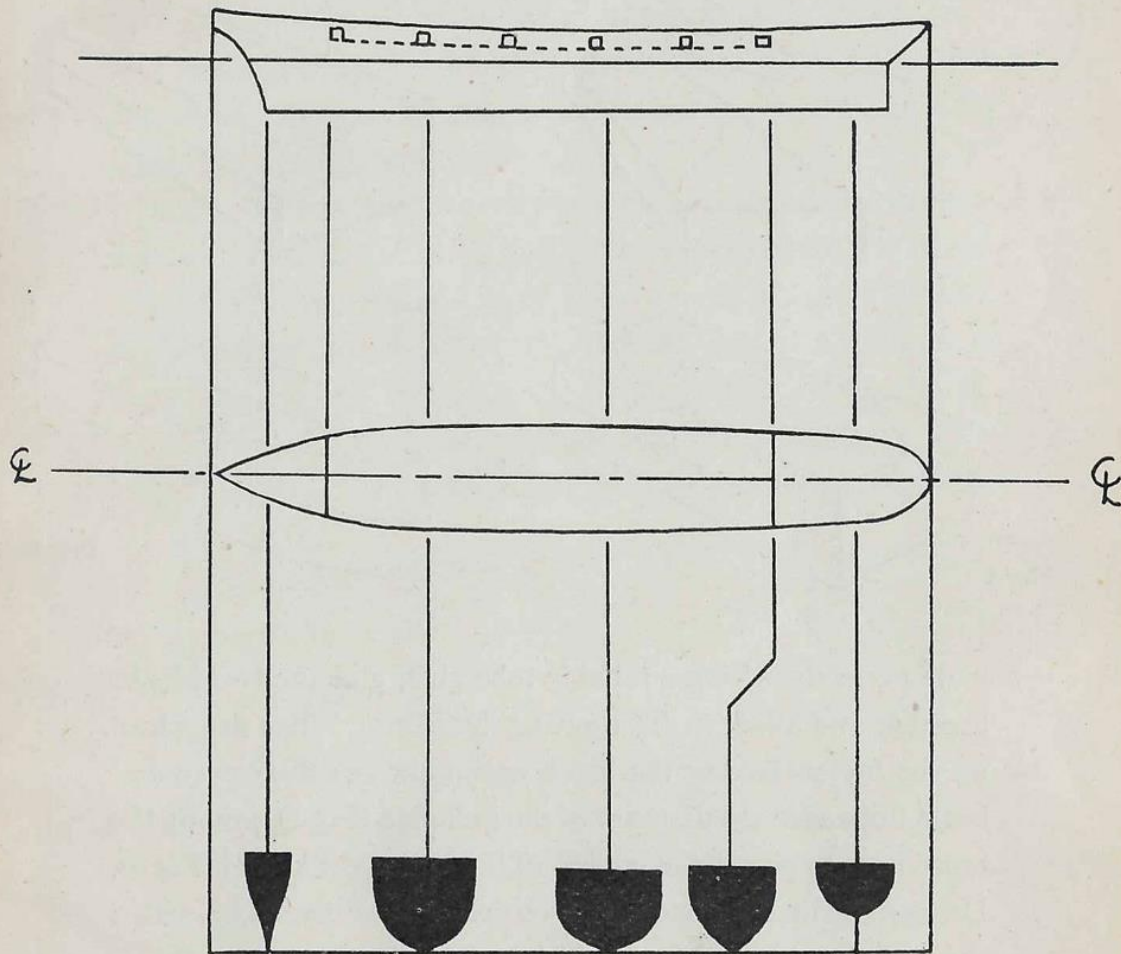


Fig 1

The lines and sections of the *Cutty Sark* model. Length : $3\frac{1}{2}$ inches
(This drawing is reduced to $\frac{6}{7}$ scale).

⁶How to use the Cross Sections, Monk, pg. 13

⁷Twisting the guard rails on my ship



factors. The masts, with spars and sails in position, must be assembled so that they can be folded flat and passed through the bottle neck. Stays must be rigged, which will serve not only to

Dimensions of all masts and spars are twice the length shown in this half-scale drawing.

- 1
 1. Jibboom spar.
 2. Jibboom.
 3. Dolphin Striker.
 4. Bowsprit.

- A. Fore topgallant mast.
 B. Fore topmast.
 C. Fore mainmast.
 1. Fore royal yard.
 2. Fore topgallant yard.
 3. Fore upper topsail yard.
 4. Fore lower topsail yard.
 5. Fore mainsail yard.

- 3
 D. Main topgallant mast.
 E. Main topmast.
 F. Mainmast.
 1. Main skysail yard.
 2. Main royal yard.
 3. Main topgallant yard.
 4. Main upper topsail yard.
 5. Main lower topsail yard.
 6. Mainsail yard.

- 4
 G. Mizzen topgallant mast.
 H. Mizzen topmast.
 J. Mizzen mast.
 1. Mizzen royal yard.
 2. Mizzen topgallant yard.
 3. Mizzen upper topsail yard.
 4. Mizzen lower topsail yard.
 5. Mizzen mainsail yard.
 6. Spanker gaff.
 7. Spanker boom.

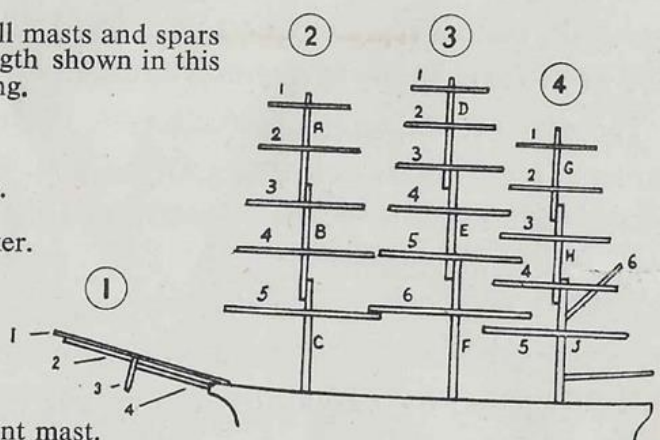
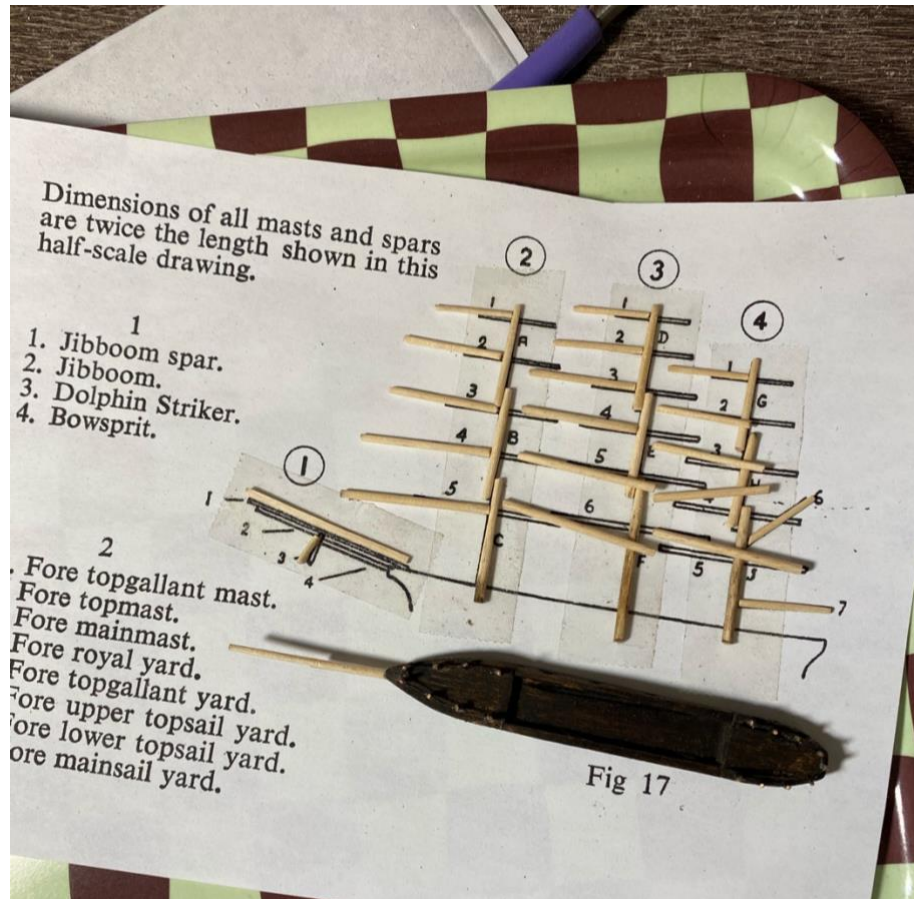
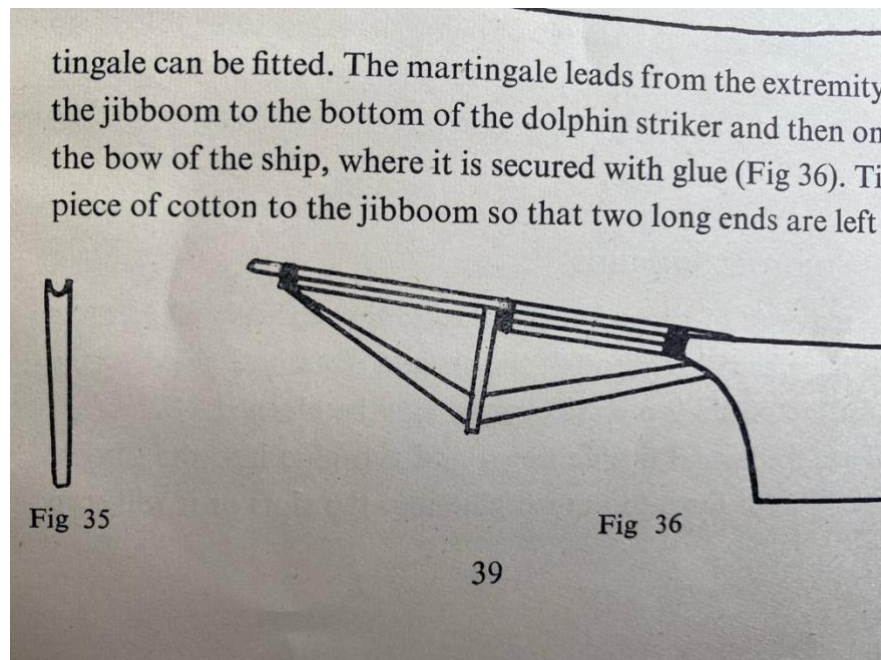


Fig 17



⁹Forming the rigging spars and mast pieces



¹⁰Dolphin striker (Fig 35) and martingale (threads attached to DS), Monk, pg. 39



¹¹*A closeup of the ship, pre-installation*



¹²*Preparing to install*



¹³*The dreaded bottleneck*



¹⁴*The completed project*

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